
APPENDIX A

**TABLES OF CHEMICAL TOXICITY
AND ROUTES OF EXPOSURE**

**WASHINGTON STATE DEPARTMENT
OF HEALTH**

Table A1. Chemical Toxicity and Routes of Exposure (Skin and Respiratory) for Solvents.		
<u>Solvent</u>	<u>Form</u>	<u>Exposure</u>
Acetone	Liquid	Eyes, Inhalation, Skin
Benzene	Liquid	Eyes, Inhalation, Skin
Benzylchloride	Liquid	Eyes, Inhalation, Skin
Chloroform	Liquid	Eyes, Inhalation, Skin
Ethanol	Liquid	Eyes, Inhalation, Skin
Ethyl Ether	Liquid	Eyes, Inhalation, Skin
Freon	Liquid	Eyes, Inhalation, Skin
Hexane	Liquid	Eyes, Inhalation, Skin
Isopropanol	Liquid	Eyes, Inhalation, Skin
Methanol	Liquid	Eyes, Inhalation, Skin
Petroleum Ether	Liquid	Eyes, Inhalation, Skin
Pyridine	Liquid	Skin, Eyes, Inhalation
<p>Health Effects:</p> <p>Inhalation of vapors at low concentration may result in mild eye, nose, and throat irritation. Symptoms of intoxication (drowsiness and lack of coordination) or loss of consciousness may occur at high doses.</p> <p>Freon spilled onto the skin may result in freezing injury to the skin.</p>		

Source: Amdur, Mary, et al. *Casarett and Doull's Toxicology: The Basic Science of Poisons*. 4th Edition. New York, NY: Pergamon Press, 1991.

Table A2. Chemical Toxicity and Routes of Exposure (Skin and Respiratory) for Cyanide.		
<u>Substance</u>	<u>Form</u>	<u>Exposure</u>
Sodium Cyanide	Solid	Skin, Eyes
Potassium Cyanide	Solid	Skin, Eyes
Benzyl Cyanide	Liquid	Skin, Eyes, Inhalation
Hydrogen Cyanide	Gas	Inhalation
Health Effects: Cyanides are highly toxic substances. If solid salt forms are mixed with acid, hydrogen cyanide gas will be released. Inhalation of hydrogen cyanide may result in rapid progression of symptoms to coma, respiratory failure and death.		

Table A3. Chemical Toxicity and Routes of Exposure (Skin and Respiratory) for Corrosives and Irritants.		
<u>Substance</u>	<u>Form</u>	<u>Exposure</u>
Acetic Acid	Liquid	Skin, Eyes, Inhalation
Acetic Anhydride	Liquid	Skin, Eyes, Inhalation
Benzylchloride	Liquid	Skin, Eyes, Inhalation
Hydroiodic Acid	Liquid	Skin, Eyes, Inhalation
Mercuric Chloride	Powder, Solid	Skin, Eyes, Inhalation
Methylamine	Gas, Liquid, Solid	Skin, Eyes, Inhalation
Perchloric Acid	Liquid	Skin, Eyes, Inhalation
Phosphine	Gas	Eyes, Inhalation
Sodium Metal	Solid	Skin, Eyes
Sodium Hydroxide	Liquid, Solid	Skin, Eyes
Thionyl Chloride	Liquid	Skin, Eyes, Inhalation
Health Effects: Vapors of volatile corrosives may cause eye irritation, heavy tearing, conjunctivitis, and corneal injury. Inhalation may cause irritation of mucous membranes of the nose and throat, and lung irritation resulting in cough, chest pain, shortness of breath. Pulmonary edema and hemoptysis may occur in severe cases. High concentrations of vapor may cause skin irritation. Additional symptoms of vapor inhalation may include headache, nausea, dizziness, and anxiety. Direct contact with corrosives may result in severe eye or skin burns.		

Source: Amdur, Mary, et al. *Casarett and Doull's Toxicology: The Basic Science of Poisons*. 4th Edition. New York, NY: Pergamon Press, 1991.

Table A4. Chemical Toxicity and Routes of Exposure (Skin and Respiratory) for Metal/Salts.

<u>Substance</u>	<u>Form</u>	<u>Exposure</u>
Aluminum	Solid	Skin, Eyes
Magnesium	Solid	Skin, Eyes
Red Phosphorous	Solid	Skin, Eyes
Iodine	Solid	Skin, Eyes
Mercuric Chloride	Solid	Skin, Eyes
Mercury Vapor	Liquid, Vapor	Inhalation
Lead Acetate	Solid	Skin, Eyes
Lithium Aluminum Hydride	Solid	Skin, Eyes
Sodium Acetate	Solid	Skin, Eyes
Sodium Hydroxide	Solid	Skin, Eyes
Sodium Metal	Solid in Kerosene	Skin, Eyes
Potassium Metal	Solid in Kerosene	Skin, Eyes
Thorium	Solid	Skin, Eyes

Health Effects:

Most metals and salts are stable solids with minimal potential for exposure unless ingested or the metal is present in the air as a dust or fumes, when heated. Sodium and potassium metal and sodium hydroxide are extremely corrosive in the presence of moisture (water). Lithium aluminum hydride is extremely reactive. Thorium is an alpha particle emitting radioactive material. Mercury vapor is of utmost concern because of its neurotoxic effects.

Table A5. Chemical Toxicity and Routes of Exposure (Skin and Respiratory) for Precursors.

<u>Substance</u>	<u>Form</u>	<u>Exposure</u>
Phenylacetic Acid	Solid	Skin, Eyes
Phenyl-2-Propanone	Solid	Skin, Eyes
Methylamine	Gas, Liquid, Solid	Skin, Eyes

Health Effects:

Phenylacetic acid may produce irritation upon direct contact. Specific toxicity on Phenyl-2-Propanone is lacking. Similar compounds are used in fragrances and pharmaceuticals. Methylamine is an irritant and a corrosive.

Source: Amdur, Mary, et al. *Casarett and Doull's Toxicology: The Basic Science of Poisons*. 4th Edition. New York, NY: Pergamon Press, 1991.

Table A6. Chemical Toxicity and Routes of Exposure (Skin and Respiratory) for Chemicals Associated With the Manufacture of LSD, MDA, and MDMA.			
Name	Form	Route	Health Affects
Acetonitrile	Liquid/Vapor	Inhalation, Ingestion	Headaches-Convulsions, possible cyanide poisoning
Alumina	Solid	Inhalation	Irritation
Ammonium Acetate	Liquid/Vapor	Eyes, Skin, Inhalation	Mucous Membrane, Skin Irritation
Ammonium Formate	Liquid/Vapor	Eyes, Skin, Inhalation	Mucous Membranes, Skin Irritation
Cuprous Oxide	Solid/Dust	Eyes, Inhalation	Mucous Membrane Irritation
Diethylamine	Liquid/Vapors	Eyes, Skin, Inhalation	Corrosive
Dimethylformamide	Liquid/Vapors	Inhalation, Skin	Irritation, at Higher doses Central Nervous System Effects
Ergot Alkaloid	Solid/Powder	Eyes, Inhalation, Skin, Ingestion	Severe Arterial Spasm/gangrene - Small Doses Lethal
Ergotamine Tartate	Solid/Powder	Eyes, Inhalation, Skin, Ingestion	Severe Arterial Spasm/gangrene - Small Doses Lethal
Ethylene Dichloride	Liquid/Vapor	Eyes, Inhalation, Skin	Irritation, Central Nervous System Effects
Formamide	Liquid/Vapor	Eyes, Inhalation, Skin	Irritation
Formic Acid	Liquid/Vapor	Eyes, Inhalation, Skin	Irritation
Isosafrole	Liquid	Eyes, Inhalation, Skin	Carcinogenic
Hydrazine	Liquid	NA	EXPLOSIVE!!!
Hydrobromic Acid	Liquid/Vapor	Eyes, Inhalation, Skin	Irritation
Hydrogen Peroxide	Liquid	Eyes, Inhalation, Skin	Irritation
Hydroxyamine	Liquid/Vapor	Eyes, Inhalation, skin	Irritation
Lithium Aluminum Hydride	Solid/Powder	Eyes, Inhalation, Skin	Corrosive, Potentially Explosive
Lithium Hydroxide	Solid/Powder	Inhalation	Central Nervous System Effects
Lysergic Acid	Solid/Powder	Eyes, Inhalation, Skin, Ingestion	Severe Central Nervous System Effects

Table A6. Chemical Toxicity and Routes of Exposure (Skin and Respiratory) for Chemicals Associated With the Manufacture of LSD, MDA, and MDMA.			
Name	Form	Route	Health Affects
N, Methylformamide	Liquid/Vapors	Eyes, Inhalation, Skin, Ingestion	Irritation
Methylene Chloride	Liquid/Vapors	Inhalation, Skin	Irritation, Central Nervous System Effects, Carcinogen
Piperonal	Liquid/Vapors	Eyes, Inhalation, Skin, Ingestion	Irritation
Potassium Hydroxide	Liquid/Vapors	Inhalation, Skin	Irritation
Raney Nickel	Solid/Powder	Inhalation	Irritation/Allergen
Safrole	Liquid/Oil	Ingestion	Carcinogen
Sodium Dichromate	Solid/Powder	Eyes, Inhalation, Skin, Ingestion	Severe Irritation/Corrosive
Sodium Borohydride	Solid/Powder	NA	Flammable/Explosive
Sodium Nitrate	Solid/Powder	NA	Flammable/Explosive
Sodium Sulfate	Solid/Powder	NA	Little Effect
Sulfur Trioxide	Gas	Eyes, Inhalation	Mucous Membrane Irritation, Corrosive
Tartaric Acid	Solid/Powder	Eyes, Inhalation, Skin, Ingestion	Corrosive Irritation to Mucous Membranes & G.I. Tract
Toluene	Liquid/Vapors	Eyes, Inhalation	Mucous Membrane Irritant, Central Nervous System Effects

Source: Amdur, Mary, et al. *Casarett and Doull's Toxicology: The Basic Science of Poisons*. 4th Edition. New York, NY: Pergamon Press, 1991.

APPENDIX A1

TYPES OF INHALED TOXICANTS AND THEIR EFFECTS

- Asphyxiants—gases, such as nitrogen, that deprive the body tissues of oxygen.
- Irritants—chemicals, such as hydrogen gas and ammonia compounds, that irritate the air passages, causing constriction of the airways and possibly edema, or liquid in the lungs, and infection.
- Necroses—chemicals, such as nitrogen dioxide, that result in cell death and edema.
- Fibroses—chemicals, such as silicates, that produce fibrotic tissue, which may block airways and decrease lung capacity.
- Allergens—chemicals, such as isocyanates, that induce an allergic response characterized by bronchio constriction and pulmonary disease.
- Carcinogens—chemicals, such as arsenic, that are associated with lung cancer.*

*Source: Lazarus, Bruce, et al. *Field Hazards and Protection Training Guide*. U. S. Drug Enforcement Administration. Clandestine Laboratory Certification Program. June, 1987.

APPENDIX A2

FACTORS INFLUENCING TOXICITY

A number of factors influence the normal dose response. These include the following:

- **Route of exposure**—the route by which a toxic material enters the body determines how much is absorbed and which organs are exposed to the highest concentration; e.g., the amount of chemical that is toxic orally may not be as toxic when in contact with the skin.
- **General health**—some materials may be more toxic to one person than to another, based on each person's nutrition, immunologic status, hormonal status, and co-existing diseases.
- **Gender**—some materials are more toxic to one gender than another, because of differences in body fat, metabolism, and reproductive systems. For example, women have a larger percentage of body fat than men; this body fat tends to retain the effects of toxic chemicals. Further, toxic chemicals cause reproductive risks for women of childbearing years.
- **Synergism, Antagonism, and Potentiation**—some combinations of chemicals produce effects different from those attributed to each individually. *Synergists* are chemicals that, when combined, cause a greater than additive effect; *antagonists* are chemicals that, when combined, lessen the predicted effect. *Potentiation* is a type of synergism in which the potentiator is not usually toxic in and of itself, but has the ability to increase the toxicity of other chemicals.
- **Age**—children and the elderly are more susceptible to the effects of certain chemicals than are average adults. Children have higher respiration rates and different metabolism rates, excretory patterns, and susceptibilities than adults; for example, children are less sensitive to central nervous system stimulants but are more sensitive to depressants than average adults. Infants are especially vulnerable to toxic substances since their immature livers lack the detoxification mechanisms found in adults. The elderly are more susceptible to the effects of certain chemicals because aging has affected their blood and hepatic systems, musculature, metabolism, and excretory patterns.
- **Genetics**—genetic differences can affect susceptibility; some people lack genes which produce enzymes that can alter the toxicity of some chemicals.
- **Environmental factors**—increased and decreased environmental temperature, increased or decreased barometric pressure, or radiation may influence a toxic response.

Each of these factors needs to be considered in order to accurately determine the relative risks of any clandestine laboratory.*

* Source: Lazarus, Bruce, et al. *Field Hazards and Protection Training Guide*. U. S. Drug Enforcement Administration. Clandestine Laboratory Certification Program. June 1987.

